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HEAT RECOVERY FROM BOILER BLOWDOWN WATER BY USING HEAT EXCHANGER IN THERMAL POWER PLANT

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ABSTRACT

Our project aims basically on recovering boiler blow down water heat by designing a heat exchanger. The temperature of blow down water in the flash tank is about 110^{0}C. This heat can be used to heat the boiler make up water through a heat recovery exchange unit on account of which fuel consumption can be reduced. By installing a heat exchanger recovery unit, the heat resident in the blow down liquid is transferred to the treated make up water. The preheated makeup water is then routed through the dearator. The main reason behind this preheating procedure is to reduce the fuel, which is the primary source of the heating.

KEYWORDS: Heat Exchanger, Blow Down, Boiler, Steam, Flash Vessel, Energy Saving, TDS, Boiler Efficiency, Heat Recovery & Dearator

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Original Article

INTRODUCTION

This report gives the thermal design for the heat exchanger required to heat the makeup water for boiler feed by the boiler blow down, which is at a temperature 110°C. The heat exchanger is designed on the basis of the capacity requirements and the temperature of boiler blow down water.

A shell and tube heat exchanger is chosen for this design, in which, the boiler blow down is in the shell side and the makeup water is in the tube side.

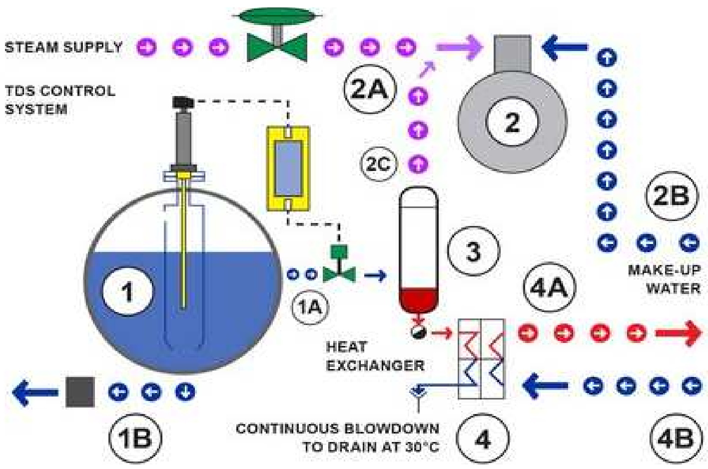

Figure 1: Boiler Blown Down System using Heat Exchanger (Taken from Online PDF)

LITERATURE REVIEW

Waste heat can be generated by various methods i.e. by fuel combustion, by chemical reaction. The recovery of the waste heat is depending on the part of the waste heat temperature. The energy cannot be converted fully into a useful work, but it recovers a maximum energy. Lots of heat energy is lost in the blow down water so it is need to recovery the heat by adding the heat exchanger. The waste heat can be utilized to heat the boiler water. The heat required to heat the boiler water is reduced. This blow down water can be used as feed water so the usage of boiler water is reduced.

METHODOLOGY

In this project, a heat exchanger is designed for utilizing the boiler continuously blow down water temperature to heat the feed water (De-Mineralization make up water), before entering the feed water tank. So, we can able to extract the heat energy from continuous blow down water before entering the feed water tank. At the same time, the blow down water temperature reduced from 110°C to 80°C, and overall efficiency of the power plant will be increased.

HEAT EXCHANGER DESIGN

This report gives the thermal design for the heat exchanger required to heat the makeup water for boiler feed by the boiler blow down, which is at a temperature 110°C. The heat exchanger is designed on the basis of the capacity requirements and the temperature of boiler blow down. A shell and tube heat exchanger is chosen for this design, in which, the boiler blow down is in the shell side and the makeup water is in the tube side.

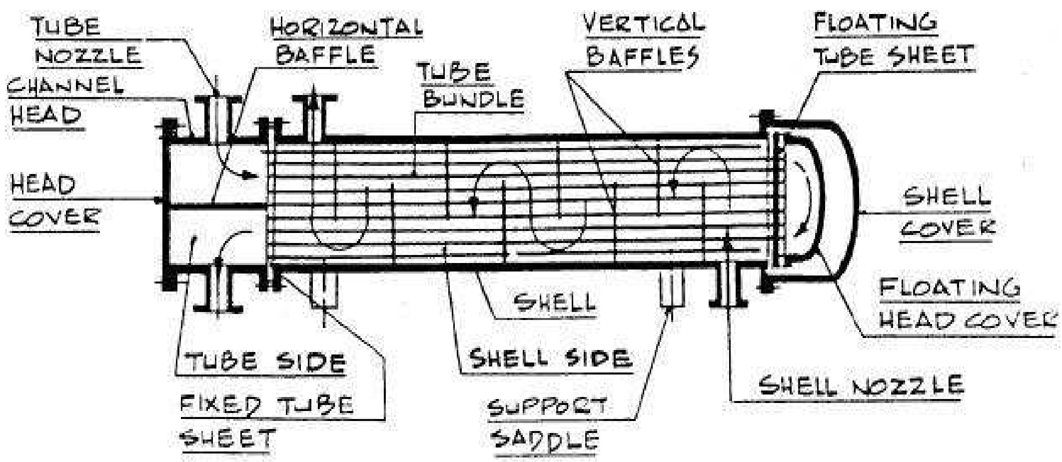

Figure 2: Heat Exchanger Parts for Design (Taken from Online PDF)

Design Condition

The following conditions are chosen as the design basis.

Shell Side

Fluid = boiler blow down (hot fluid)

Mass flow rate of hot fluid (mj) = 6260 Kg/hr = 1.74Kg/sec

Temperature of the hot fluid at the inlet of heat exchanger (Th1) = 110°C

Tube Side

Fluid = make up water for the boiler feed (cold fluid)

Mass flow rate of cold fluid (me) = 20 tonnes/hr = 5.56 Kg/sec

Temperature of cold fluid at the inlet of heat exchanger (Tc1) = 35°C

Temperature of cold fluid at the outlet of heat exchanger (Tc2) = 55°C

Counter flow arrangement is chosen for the first pass.

Heat Load for Heat Exchanger

$Q = mc\ Cp, c\ .\ \Delta T$

$= 20000\ (4.187) \times (55 - 35)$

$= 1674800$ KJ/hour

$Q = 467$ KW

The Energy Saved Here

Q max =467 KW

Q = € X Qmax

Effective of water to water heat exchanger can be taken as .75

Q = .75 x 467

= 350. 25 kw"

Fuel Saved Here

Fuel saved here = (Energy saved) / (Efficiency of boiler x calorific value of Fuel)

= 350.25 / (0.8 x 12960)

= .03 kg/sec

= 121.6 kg/hr

= 1065.34 tonnes / yea

Cost Savings

Cost savings = cost of coal x fuel saved

= Rs. 3850 per tonnes x 1065.34 tonnes per year

= Rs. 4101573.44 per year.

RESULTS AND DISCUSSIONS

Thus, the heat exchanger is designed to utilize the waste heat from the blow down water to preheat the boiler feed water. The heat exchanger recovered some amount of heat energy from the blow down water without wasting it to atmosphere. Thus, the energy saved from blow down water is used for preheat the feed water. The feed water inlet air temperature gets increased and the blow down water temperature is reduced. The increased water temperature increases the effectiveness of the burning and reduces the fuel consumption. The reduced fuel consumption reduced the money spent for the fuel. Thus, it‘s an economical benefit of the company.

CONCLUSIONS

The boiler blow down water heat is recovered by designing a heat exchanger. The temperature of blow down water in the flash tank is about 110^{0}C. This heat can be used to heat the boiler make up water through a heat recovery exchange unit, on account of which fuel consumption can be reduced.

Thus, by using the heat exchanger I have designed, it is possible to preheat the makeup water by 20^{0}c, which will result in the following savings.

- **Energy saved - 350.25 kw**
- **Fuel saved - 1065.34 tonnes of coal**
- **Cost saved - 4101573.44 per year.**

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REFERENCES

1. *Thermal Engineering text book by Domkundwar & Arora*
2. *Heat Transfer text book by Younis.A. Cenegal*
3. *Design of Fluid and thermal system text book by william s. Janna.*
4. *Apogee. netCo3.*
5. *Aii season shine.co.*
6. *Thermodyne boiler.com.*
7. *Bdi cooling.com.*
8. *Piping Engineering .com.*
9. *Performance Analysis of blow down heat recovery system-srd/vol.3/issue/03/2015/674.*
10. *Mahrous, A. (2013). Thermal performance of PCM based heat sinks. Int J Mech Eng, 2(4).*
11. *10. http.//www.ijett journal.org.*